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(21) International Application Number: PCT/GB90/00126 (22) International Filing Date: 29 January 1990 (29.01.90) (30) Priority data: 8921397.9                      21 September 1989 (21.09.89) GB 8923196.3                      14 October 1989 (14.10.89) GB (71) Applicant (for all designated States except US): NEWSHAM HYBRID PIGS LIMITED [GB/GB]; Musley Bank House, Malton, North Yorkshire YO17 0TD (GB). (72) Inventor; and (75) Inventor/Applicant (for US only) : BRISBY, Ian, Robert [GB/GB]; Musley Bank House, Malton, North York- shire YO17 0TD (GB).			(74) Agent: BAILEY, WALSH & CO.; 5 York Place, Leeds LS1 2SD (GB). (81) Designated States: AU, BE (European patent), CA, DE (European patent)*, DK (European patent), FR (Euro- pean patent), GB (European patent), IT (European pa- tent), JP, NL (European patent), NO, US. Published With international search report.

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Improvements Relating to the Rearing of Animals

This invention relates to the rearing of animals, and provides an apparatus for rearing animals, especially but not exclusively pigs.

In the rearing of pigs for market, it is obviously most desirable to rear the pigs to the optimum condition in the shortest possible time, and utilising the minimum amount of feedstuff.

The optimum condition can be thought of as when the pig carries the maximum amount of lean meat and the minimum amount of fat, and obviously it is desirable to rear the pig to this optimum condition in the minimum time and using the minimum amount of feedstuff.

To enable the farmer or breeder to achieve or approach the optimum condition, he must monitor the growth and condition of his pigs on a regular basis, and methods of feeding the animals by allowing them to compete for feedstuff from a common trough are no longer acceptable.

Rearing methods involving electronic monitoring have therefore been introduced to assist the pig farmer in his quest for achieving the optimum condition of his animals. Electronic monitoring comprises providing the pigs each with its own transmitting device, and a feed hopper which allows only one pig to eat at any one time, and a receiver which can detect the presence of the individual animals. The hopper is electronically weighed so that by taking weighings of the hopper before and after each animal feeds, so the amount of feedstuff taken by each animal at each feed can be monitored. This electronic monitoring system, of which we have described one example in U.K. Patent 2190574 enables the farmer to be

provided with a great deal of information about the feeding habits of his pigs, and he can identify which of the animals are receiving too much feedstuff and which are receiving too little. He is therefore in a more informed position to enable him to better ensure that all animals receive sufficient feedstuff. This is important in the case of pigs which are aggressive towards each other and will fight to gain access to the feeding stall or will bite other pigs in the feeding stall. Consequently, weaker pigs tend to be deprived of an adequate supply of foodstuff and stronger pigs tend to eat at a rate such as to cause the creation of undesirable layers of fat.

In the known apparatus as described in the aforesaid patent, the feed cell or cubicle is provided with an infra red detection beam which is reflected by the pigs body each time a pig enters the cubicle. The reflection of that beam causes a control system to detect which pig is in the cubicle so that that particular pig can be related to the amount of feedstuff which is consumed during the period the pig feeds at the hopper.

The difficulty with such a system is that the infra red beam can reflect spuriously for example because of dust and debris in the atmosphere which leads in general to unsatisfactory operation of the system. Also, the infra red optical sensing system may miss the pig or may fail to reflect off the pigs body.

The present invention in one aspect seeks to provide an improvement on the existing control system, and in accordance with the invention in one aspect, an animal feeding system comprises an animal feed stall which can be occupied only by one animal at a time, a plurality of individual transponders for connection to, to be carried by, respective animals, a

trigger device carried by or located adjacent the stall to trigger the transponder of any animal which approaches the stall to a predetermined extent for the purposes of feeding from the stall, whereby the animal's transponder will emit arrival signals, a detection means for detecting said arrival signals for identification of the particular animal, and control means for co-relating the particular animal with the amount of feedstuff which is consumed between the time when the animal enters the stall and when it leaves.

The trigger signal preferably is continuously emitted. By using a trigger signal to trigger the animal transponders, especially when the signal is emitted continuously, a much more reliable detection of animal arrival is achieved compared to the utilisation of the animal for the interruption of an infra red beam, because the continuously emitted trigger signal is "looking" for specific articles namely the transponders compared to an infra red beam which simply "looks" for movement.

It is preferred that the control means is operated only when the detection means detects the presence of an animal in or adjacent the cubicle.

The trigger means may comprise an electrical aerial, for example in the form of a length of coiled or co-axial cable which may be located in any suitable position on or adjacent the stall. The cable may for example be formed into a loop in order to provide better signal characteristics. The loop may be located for example on a side wall partially defining the cubicle. The cable may be located to the inside of the wall, and the wall may be shielded for example by electrically insulating materials such as plastics materials in order to isolate the aerial from other animals which may approach the stall, not necessarily to feed but coincidentally and which

may be located to the outer side of the said wall. The outer wall of the cubicle preferably is of steel so that it does not allow the trigger radio frequency signal to escape nor indeed the animal transponder signal. The inner wall is of plastic or glass fibre to shield the receiving antenna and excitation coil from the pig transponder but allows the RF to pass therethrough.

As disclosed in said prior patent, the feedstuff may be carried by a hopper which is suspended by a weighing device, the hopper having an opening through which the animals can feed when in the stall. The said detection means may be for example a detection antenna which is looped around the said opening to provide better detection characteristics.

In order to ensure that the cubicle accommodates only one animal at a time, it preferably comprises spaced side walls and a base on which the animal stands, and between the side walls and the base there are mutually inclined plate portions which in a downwards direction are mutually convergent so that the width of the base is less than the spacing between the walls at a height where the animals body will be located.

The sloping plate portions force the animals feet into a relatively narrow width base, and this provides an extremely effective modification of the stall preventing two animals from entering the stall at any one time.

The cubicle need be of a length only to accommodate the front half of the animal and in the case of pigs this can be advantageous insofar as if the rear end of the animal is exposed, other pigs can annoy and bite the feeding animal to ensure that it does not remain in the stall for too long a period.

The aforesaid stall modification in itself constitute a second aspect of the present invention and a stall with the sloping plate portions can be used generally i.e. with or without any particular control system.

The present invention, in embodiments of its various aspects, will now be described, by way of example, with reference to the accompanying diagrammatic drawings, wherein:-

Fig. 1 is a perspective view of a feeding stall according to an embodiment of the invention;

Fig. 2 is a part-sectional elevation of the stall shown in Fig. 1;

Fig. 3 is a diagrammatic view of the electronic control circuit used for animal detection;

Figs. 3A to 3F respectively show the operation of the detection and control circuit;

Fig. 4 shows how the detection antenna may be arranged in relation to the feed hopper; and

Fig. 5 shows a modified form of feeding cubicle embodying an animal weighing crate.

Referring to the drawings, and firstly to Figs. 1 and 2, an animal feeding cubicle 10 comprises a rear casing 12 which contains a feedstuff hopper 14. The hopper 14 is suspended from a suspension frame 16 comprising upright legs 18, 20 and a cross bar 22. The hopper 14 is shown as being suspended by a weighing device 24 connected between cross bar 22 and a bar 26 forming part of the hopper 14.

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The casing 12 as shown is generally rectilinear having a front 28 a rear 30 and sides 32 and 34.

Connected to the front 28 is a cubicle 36 which is a rectilinear metallic housing similar to casing 12, and it is secured to the front 28 by means of flanges 38, 40 and fixing devices such as screws 42.

The cubicle comprises a top 44, sides 46 and 48, and it is open at the front 50. The cubicle 36 also has an inner tray 52 forming a base 54 for the cubicle and from the base extend upwardly and outwardly plate portions 56 and 58, which lead to parallel inner side wall portions 60, 62 which are in turn topped by terminal edges 64 and 66.

The tray 52 in having the inclined plate portions 50 and 58 forms a means whereby only a single animal e.g. the pig 68 can stand in the cubicle to feed from the hopper 14 (as will be explained) at any one time. The cubicle receives only the front end of the pig as shown, and this is an advantage in relation to the feeding of pigs, because other pigs can attack and bite the feeding pig so that it does not remain in the cubicle for too long a period. It is healthy for the breeding of pigs that they should compete for feedstuff.

If reference is made to Fig. 2, it will be seen that the rear of the cubicle 36 is provided with an opening 70 as is the front 28 of the casing 12, the casing opening being indicated by reference 72, so that the pig 68 can feed through these openings from a well 74 in the front of the hopper 26. The hopper as shown has a base which in general slopes from the rear to the front well 74 so that the feedstuff will flow into the well 74 to enable feeding by the pig 68. The hopper is supported on the frame 16 by means of parallelogram arms 75, 76 which are pivotally mounted in bearings 78 and 80 on



the uprights 18, 20, and bearings 82 and 84 carried in reinforcing bars or channels 86 on the sides of the hopper 14. The hopper therefore floats relative to the frame 16 except that it is supported and weighed by the weighing device 24.

As each animal 68 arrives at the cubicle feeding position, it can consume as much feedstuff as it wishes or as it is allowed to do by the other pigs who may annoy the feeding pig at its rear end. In this connection as shown in Fig. 1 the cubicle 36 can be extended as indicated by reference 87 so as to cover the entire animal.

As the pig eats from the well 74 so the total weight of the hopper 14 decreases, and if a measure of the weight of the hopper and its contents is taken before and after the feeding of a particular pig, then the amount of feedstuff consumed by that pig can be recorded.

The stall is associated with an electrical detection and control arrangement, which is illustrated diagrammatically in Fig. 3.

The system comprises an aerial 90 connected to or located close to the stall 10 which aerial continuously transmits trigger signals 92 looking for individually characterised transponders 94 carried by the respective pigs 68. When a pig approaches the cubicle 36 to enter same for feeding, the aerial triggers the transponder 94 which results in the emission from the transponder 94 of that pigs unique signal as dictated by the transponder. This is picked up by an antenna 96 suitably located, for example adjacent the hopper, to provide a recognition signal for the specific animal. The recognition signal is transferred to a microprocessor 98 forming the control unit of the system, and the arrival of

that signal instructs the control unit to calculate the amount of feed consumed by the pig 68. In this connection a signal line 100 couples a load cell 102 in the weighing device 24 to the central processor 98.

The processor 98 is also coupled to the aerial 90 via the line 104, and an output 106 from the processor leads either to a VDU unit 108 and a printer 110.

The central processor may be adapted to be driven 110 or 240 V ac as appropriate.

The printer 110 and screen 108 form a means of providing close monitoring of each pigs eating habits.

The coil 90 and the receiving antenna 96 are illustrated diagrammatically in the diagrams, but it should be mentioned that they are preferably housed completely within the cubicle. Additionally the receiving antenna 96 must not be able to receive a signal from a transponder tag that is not completely within the stall or cubicle and its range is adjusted accordingly so that it only picks up those pigs approaching the vicinity of the feed hopper at one end of the stall.

Referring to Figs. 3A - 3F, these figures show diagrammatically the manner in which the control system functions.

In each of the Figs. 3A - 3F, the stall 10 is illustrated as are the other significant components of the control system. The casing 12 and the cubicle 36 are shown, and also illustrated diagrammatically is the aerial 90, the antenna 96, the processor 98 and the load cell 102. Each figure also illustrates graphically a load cell reading, which is

indicative of the weight of feed in the hopper. In the position shown in Fig. 6, the apparatus is quiescent in that no pig is in or close to the cubicle 36 such as to pick up the signals 92 which are being emitted by the aerial.

In Fig. 3B a pig 68 with its transponder 94 approaches the cubicle 36 for the purposes of feeding from the hopper. The transponder 94 comes within the detection range of the signal 92, and this activates the transponder which in turn sends a signal 93 which is picked up by the antenna 96. The processor 98 detects this signal 93 which is unique to the animal 68 and if the load cell 102 is not activated, it is activated by the processor 98 at this time so that the weight of the load cell is recorded. This weight is indicated by X in the load cell characteristic which is indicated adjacent each figure. The weight of the feed in the hopper at this position can be considered to be represented by the amount X.

As shown in Fig. 3C, the animal enters the cubicle 36 but has not yet commenced feeding. The signals 92 continue to be emitted as do the signals 93 so that the animal is continually identified. In Fig. 3D the animal is shown as having commenced eating, and the load cell characteristic in fact takes the form shown insofar as the load cell reading starts to fall with the removal of feedstuff from the hopper 26. However the load cell characteristic has periods of quiescence 120 interspaced with periods 122 when the load cell reading is unstable but is in general dropping. During the periods 122 the animal is in fact in contact with the hopper and will be causing same to vibrate so that the load cell reading is unstable.

In view of the fact that the load cell reading does have this characteristic whilst the animal is feeding, it is important that the calculation of the amount of feedstuff consumed

should not be made too early i.e. during one of the intermediate quiescent periods 120. The programming of the processor is arranged to take account of this.

In Fig. 3E, the animal is starting to retreat from the stall, the animal having finished eating or having been arranged by the animals, and the load cell reading has settled at the quiescent reading Y. The signals 92 and 93 continue to be emitted and therefore the processor 98 does not at this time perform the calculation of the amount of feedstuff consumed. In Fig. 3F however the animal 68 has retreated to such an extent that its transponder 94 is no longer within the influence of the signals 92, and therefore the signals 93 terminate and this is detected by the processor 98 which can therefore instruct the control system to note the reading Y on the load cell and to calculate the amount of feedstuff consumed by the animal 68 which is equal to  $X - Y$ , and that feed can be allocated to that animal.

It may be that another animal will come under the influence of the signal 92 before animal 68 is out of the influence of that signal, in which case the arrival of a new signal 93 will instruct the processor 98 that the first animal has finished feeding and to make the calculation  $X - Y$  for animal 68 before commencing the monitoring of the feeding of the next animal. Alternatively, the sphere of influence of the signal 92 can be made such that only one animal physically can be detected at any one time.

The Figs. 3A to 3F illustrate that the signal 92 is continuously emitted so that a constant monitoring is taking place. The system also recognises that the load cell signal during feeding has the characteristic shown in Fig. 3D and takes account of this in the calculation of the quantity consumed by each animal.

A similar detection arrangement can be provided for the case when the animal when feeding has to step into a weighing crate for weighing the animal as described in relation to Fig. 5.

The aerial 90 which is a trigger signalling device may be located in any suitable position, but Fig. 2 shows that the aerial may be a loop located on the inner face of side 46 of the cubicle. The loop 90 may be a co-axial or coiled cable and may be fitted on a plastic lining so as to be offset from the metallic side of the cubicle 36. It preferably protrudes forward as shown in Fig. 2 relative to the side of the cubicle to continue transmitting when the pigs head is in the trough. The receiving antenna 96 may also be in the form of a co-axial cable and formed into a loop, for example as shown in Fig. 4 wherein the cable is looped around the aperture 72 in the front of casing 12 and through which the animal's head passes whilst it is feeding, in order to ensure best reception.

The cubicle 36 and the casing 12 may be provided with an internal lining, for example of plastics material or glass fibre in order to electrically insulate the internal spaces of the casing and cubicle. The tray 52 may be formed of such materials if required.

In the arrangement shown in Fig. 1, the tray 52 is static, but it is possible to provide that the cubicle be provided with an animal weighing crate of the form shown in Fig. 5. In this arrangement the tray 52 is replaced by means of a crate 212 which has a profile similar to the tray 52, but the crate 212 is suspended from the cubicle sides 46, 48 by means of a cross bar 214 and weighing device 216, the weighing device 216 being connected between the cross bar 214 and a

support bar 218 connected to the top edges of the crate 212. As the animal enters this cubicle and stands on the crate 212, its weight can be taken via the weighing device 216, which is provided with a load cell coupled in turn to the processor 98. Each time each animal enters the weighing crate 212, its weight can be recorded so that the animal weight along with its food consumption can be monitored and checked throughout the growth period.

The cubicle 36 and the casing 12 may be anchored to the floor by means of anchoring devices 220 as shown in Fig. 2.

The apparatus described utilises a novel form of detection system and the desirable feature that the cell is provided with the sloping plate portions permitting only one animal at a time to enter. Each of these aspects is significant in a combined system according to the invention, but it is also to be pointed out that each aspect constitutes a separate inventive novelty.

Modifications of the inventions may be made without departing from the scope of same. The control system provides for rapid animal sensing whilst the animal is near but not touching the feed hopper, and the sloping side design restricts the entry of other animals. In a preferred case the stall will have a metal exterior to shield the pig transponder from outside interference and there will be an interior plastic lining of plastic or glass fibre to house the interrogation system which in the preferred form is set to interrogate only one animal at a time.

CLAIMS

1. An animal feeding system comprising an animal feed store which can be occupied only by one animal at a time, a plurality of individual transponders for connection to, to be carried by, respective animals, a trigger device carried by or located adjacent a stall to trigger the transponder of any animal which approaches the stall to a predetermined extent for the purposes of feeding from the stall, whereby the animal's transponder will emit arrival signals, a detection means for detecting said arrival signals for identification of a particular animal, and control means for correlating the particular animal with the amount of feedstuff which is consumed between the time when the animal enters the stall and when it leaves.

2. A system according to Claim 1, wherein the trigger signal is continuously emitted, and the detection of the animal leaving the stall is given when the detection means fails to detect arrival signals from the animal.

3. A system according to Claim 1 or 2, wherein the trigger means comprises an electrical aerial.

4. A system according to Claim 3, wherein the aerial comprises a length of coiled or co-axial cable located in any suitable position on or adjacent the stall.

5. A system according to Claim 4 wherein the cable is formed into a loop and the loop is located on the inside of a side wall partially defining the cubicle.

6. A system according to Claim 5, wherein the cable is shielded from the cubicle wall by means of insulating material such as plastics material.

7. A system according to any preceding claim, including a hopper for containing feedstuff, said hopper being suspended by a weighing device, and the hopper having an opening through which the animals can feed when in the stall, said weighing device being connected to said control means to give indications of hopper weight before and after each animal feeds at the hopper.

8. A system according to Claim 7 wherein the detection means comprises a detection antenna which is looped around the said opening in the hopper.

9. A system according to any preceding claim wherein the cubicle comprises spaced side walls and a base on which the animal stands, and between the side walls and the base there are mutually inclined plate portions which in a downwards direction are mutually convergent so that the width of the base is less than the spacing between the walls at a height where the animal's body will be located.

10. A system according to Claim 9, wherein the cubicle is of a length to accommodate only the front half of the animal.

11. A system according to Claim 9 or 10, wherein said base forms part of a weighing crate which is suspended by an animal weighing device so that the animal can be weighed by the control means each time it enters the cubicle.

12. An animal feeding cubicle for accommodating only one animal at a time comprising spaced side walls and a base on which the animal stands, and between the side walls and the base there are mutually inclined plate portions which in a downwards direction are mutually convergent so that the width of the base is less than the space in between the walls at a



height where the animal's body will be located.

13. A cubicle according to Claim 12, wherein said base and inclined plate portions are defined by a U-sectioned tray having open ends.

14. A cubicle according to Claim 13 wherein the said tray is suspended by means of a weighing device so that each time the animal enters a cubicle and stands on the base, it can be weighed.

15. An animal feeding system substantially as hereinbefore described with reference to the accompanying drawings.

16. An animal feeding cubicle substantially as hereinbefore described with reference to the accompanying drawings.

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1-4

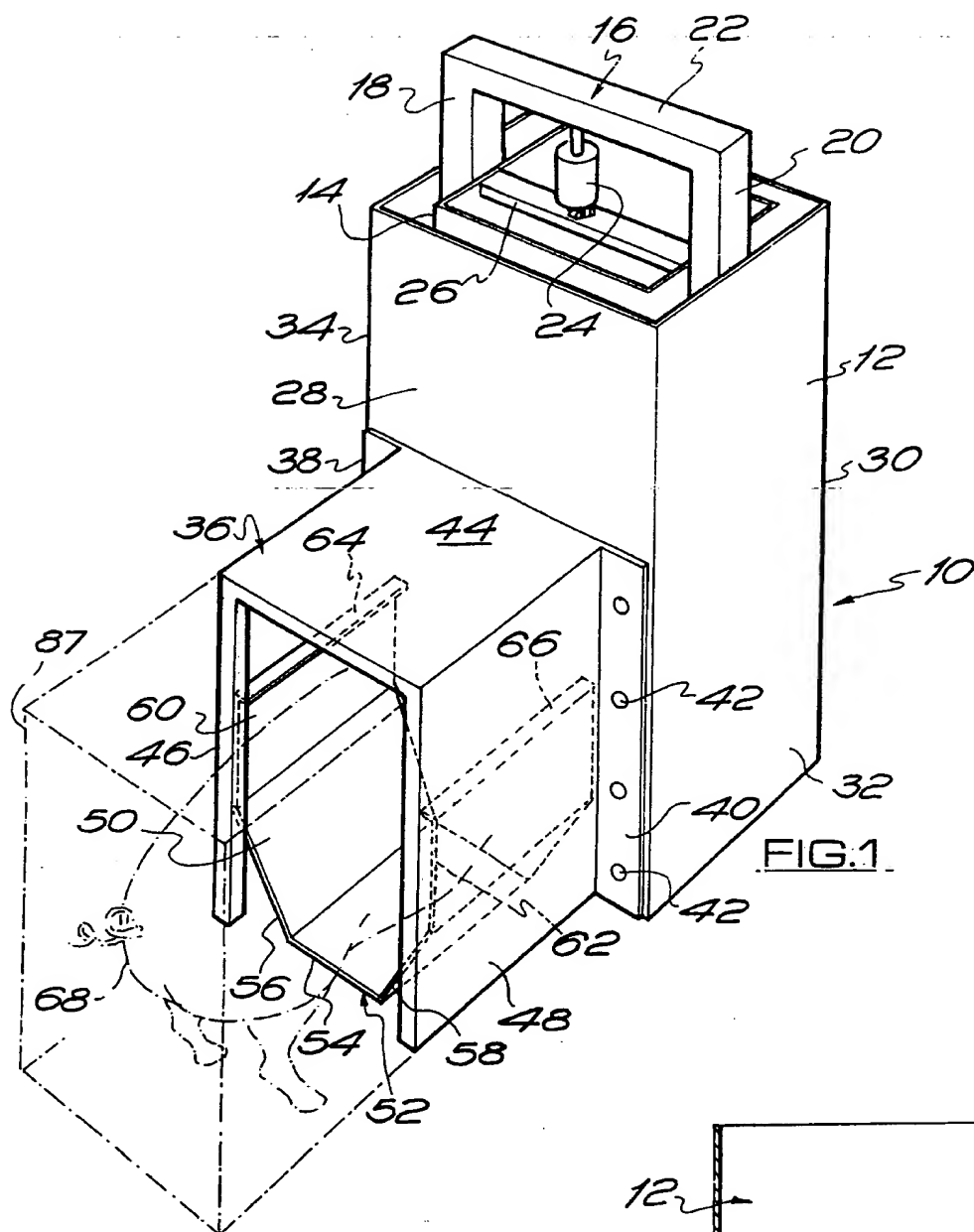


FIG. 1

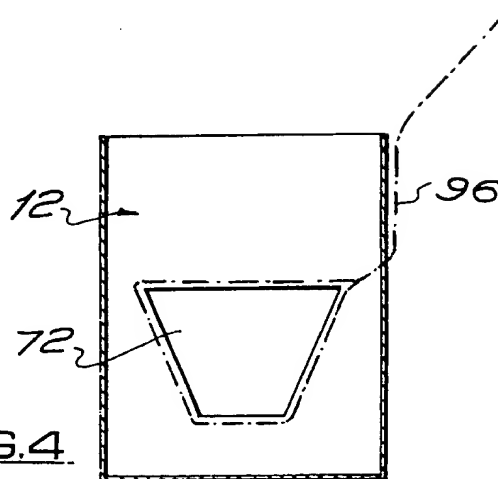


FIG. 4

SUBSTITUTE SHEET

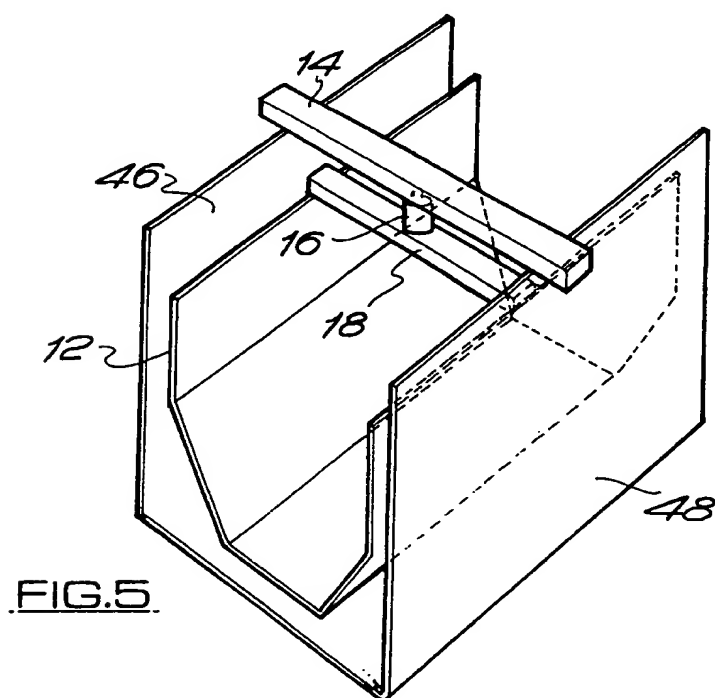
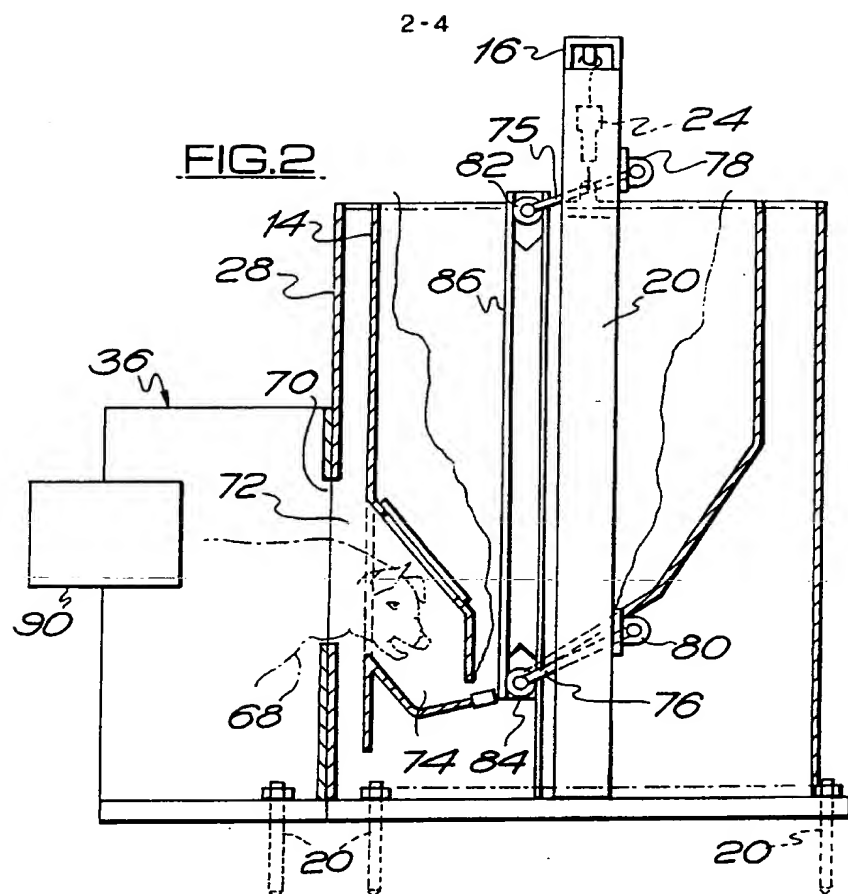
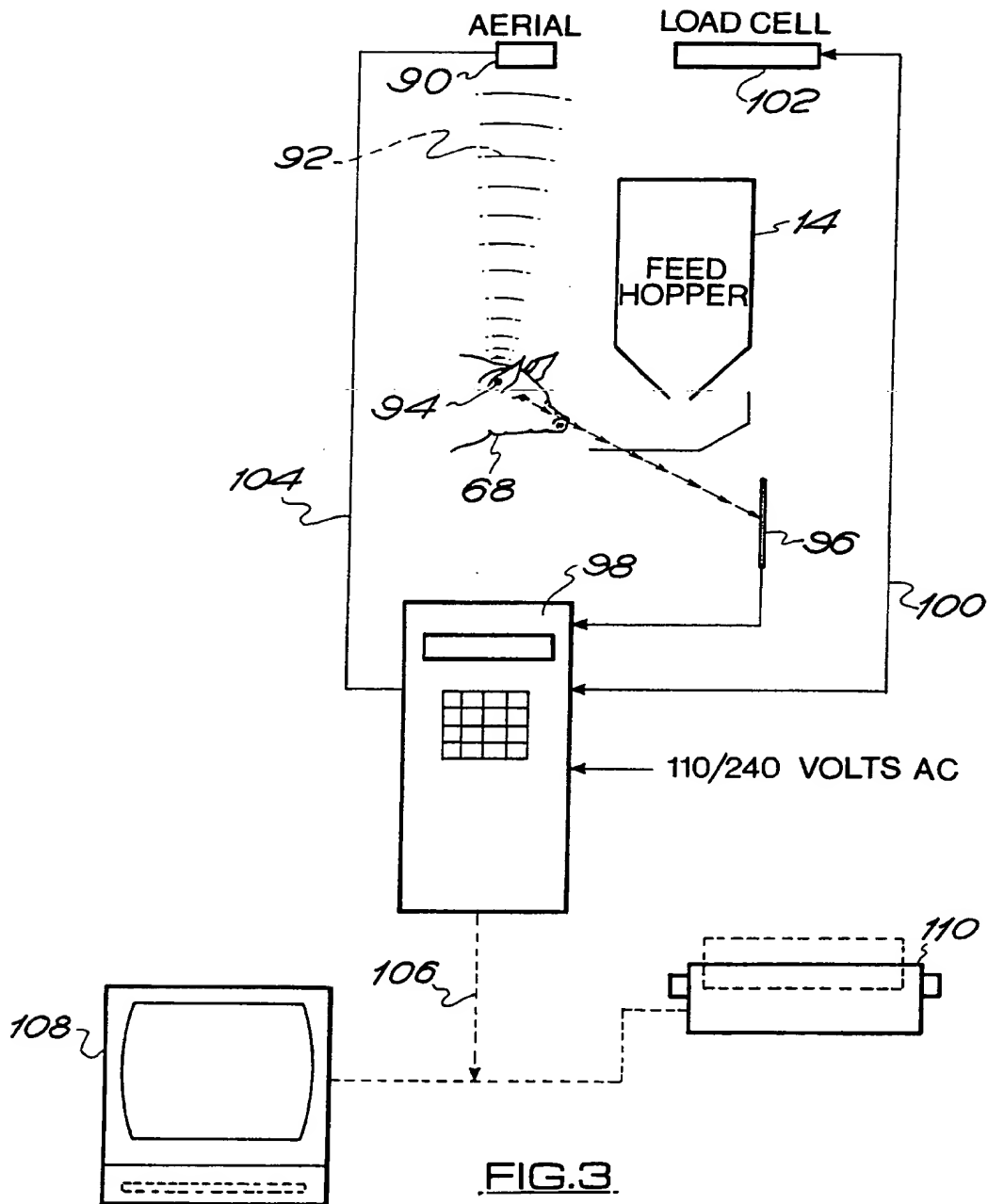


FIG.5

3-4



4-4

FIG.3A

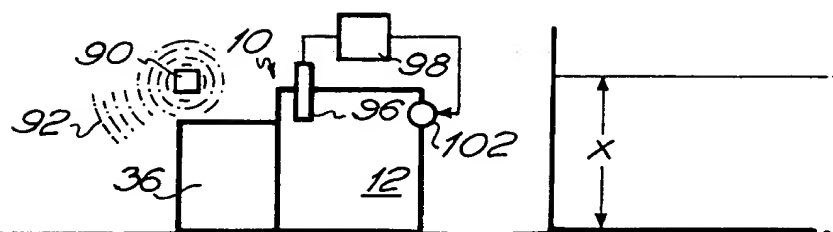


FIG.3B

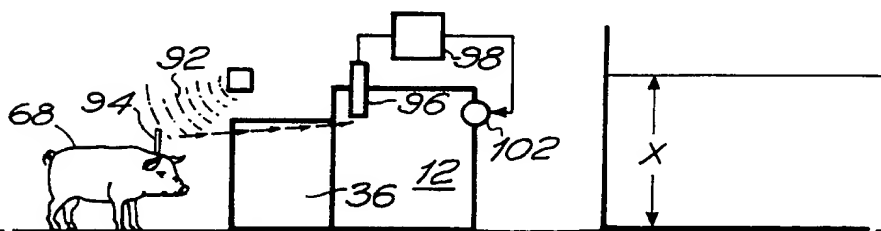


FIG.3C

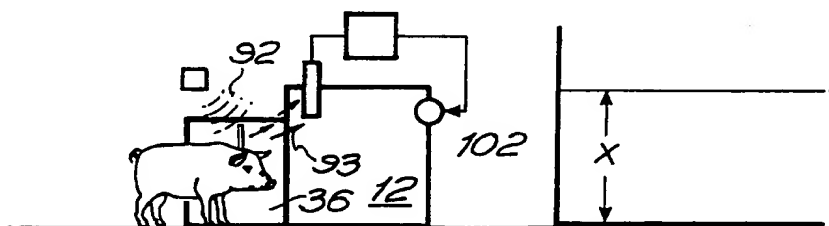


FIG.3D

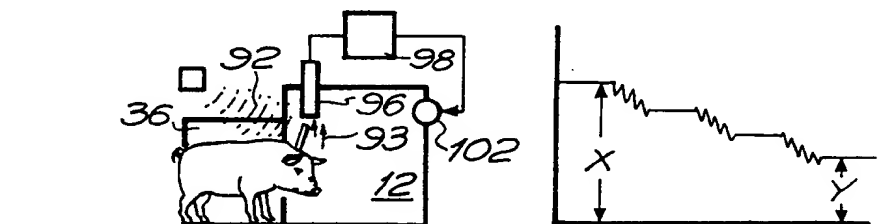


FIG.3E

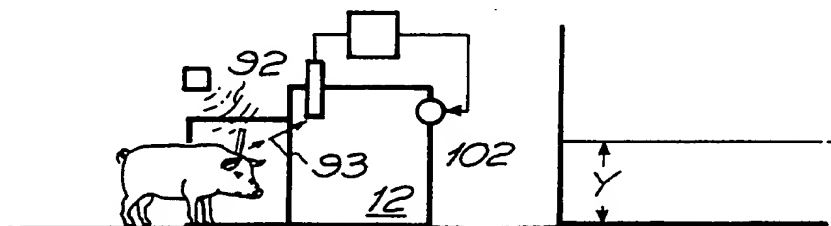
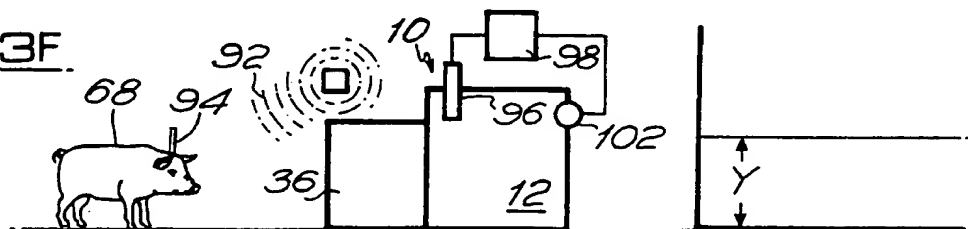



FIG.3F



# INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 90/00126

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) *		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC <sup>5</sup> : A 01 K 1/02, A 01 K 11/00		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System <sup>1</sup>	Classification Symbols	
IPC <sup>5</sup> A 01 K, A 22 B		
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched <sup>8</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup></b>		
Category <sup>6</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
Y	EP, A, 0331269 (DE JONG) 6 September 1989 see the whole document ---	1-8,15
Y	GB, A, 2190574 (BRISBY) 25 November 1987 see page 1, line 124 - page 2, line 22; figures 1,6,7 ---	1-8,12-16
A	cited in the application ---	11-14,16
A	US, A, 3562854 (SCHMIDT) 16 February 1971 see column 2, lines 9-13; figure 2 ---	9,12
A	EP, A, 0299557 (HOGEN) 18 January 1989 ---	
A	WO, A, 8800007 (ALFA-LAVAL AGRI INTERNA- TIONAL AB) 14 January 1988 ---	
A	DE, A, 3623816 (VOGL) 22 January 1987 -----	
<p>* Special categories of cited documents: <sup>10</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"A" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
17th September 1990	12. 10. 90	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	R.J. Eernisse 	

**FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET**

**V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE <sup>1</sup>**

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers ..... because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☐ Claim numbers ..... because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3. ☐ Claim numbers ..... because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

**VI. ☒ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING <sup>2</sup>**

This International Searching Authority found multiple inventions in this international application as follows:

1. Claims 1-11, 15
2. Claims 12-14, 16

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.
2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:
  
3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:
  
4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

- ☐ The additional search fees were accompanied by applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO.**

GB 9000126  
SA 34144

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 09/10/90. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A- 0331269	06-09-89	NL-A- 8800546	02-10-89
GB-A- 2190574	25-11-87	None	
US-A- 3562854	16-02-71	None	
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DE-A- 3623816	22-01-87	AT-A,B 383723	10-08-87